Section 3. Outstanding Projects of 2005

Five projects in this year's annual progress report exemplify outstanding coordination, design, and implementation:

- Stibnite Mine restoration, which includes the Glory Hole and Meadow Creek Projects, 2003-2005
- South Fork Cottonwood Creek Watershed Enhancement Project – Phase I, 2001-2004
- Upper Thomas Fork Creek Stream Bank Stabilization Project, 2003-2005
- Kinsey Corral Relocation and Riparian Fencing Project, 2001-2005
- Perrine Coulee Irrigation Return Flow Settling Ponds and Wetlands Project, 2003-2005

Summaries for each of these outstanding projects are presented in the following.

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Stibnite Mine Restoration: Glory Hole and Meadow Creek Projects

The goals of this multi-pronged effort have been to eliminate nonpoint source production and delivery of sediment and metals from historic mine roads, abandoned mill tailings impoundments, and mine waste dumps for the Glory Hole and Meadow Creek projects. Located along the *East Fork of the South Fork of the Salmon River* watershed, in eastern Valley County, Idaho, the project lies in the heart of salmon country and is one of only four drainages in the Columbia Basin that supports populations of B-run wild, native steelhead (*Oncorhynchus mykiss*). Adfluvial Bull Trout (*Salvelinus confluentus*) and cutthroat trout (*Oncorhynchus clarki lewis*) also occupy these waters, completing a very complex salmonid community.

The watershed also has socio-economic significance, providing multiple beneficial uses for Idahoans and tribal rights, such as subsistence hunting and fishing and religious practices, for the Nez Perce and Shoshone-Bannock tribes. Land uses in the watershed include road construction, logging, mining, hunting and fishing. Approximately 100 miles of rural county roads, and millions of tons of heavy-metal-ladened mine and mill tailings in the watershed, have been exposed to wind and water erosion. Production and delivery of sediment and heavy metals caused degradation of water quality and fisheries habitat throughout the watershed.

Poor water quality, adverse modifications to aquatic habitat, and creation of barriers to natural fish passage have been the three biggest problems in the watershed.

Over $800,000 in section 319 Grants were awarded to DEQ to implement the Meadow Creek Restoration and Glory Hole Projects; over $300,000 in state general funds and $125,000 of volunteer, in-kind labor contributions have supplemented the section 319 funds.

Completed Tasks: Glory Hole

Tasks completed for the Glory Hole project include the following:

<u>Bradley Waste Dump Removal</u>

Overlooking the Glory Hole is the massive Northwest Bradley Waste Dump, site for disposal of what appeared to be mill tailings and laboratory wastes. Risk analysis indicated that metals concentrations at the surface posed a significant health risk to tourists and that leaching of these metals and those in the interior of the dump contributed to metals concentrations in the river.

DEQ, the USDA, and EPA collaboratively designed removal projects to encapsulate tailings over an area of significant recharge to the dumps, thereby eliminating both the exposure for visitors and reduce the leaching of metals from the dump. A composite cap, consisting of Bentomat®,[2] top soil and vegetation should reduce these risks significantly.

Monday Camp Dump Access Road Closure

The only access to the Monday Camp was the cause of significant stream bank instability, responsible for production and delivery of in excess of five (5) tons of sediment per year (Figure 3).

Figure 3. Approximately 1.5 miles of access road to the Monday Camp Dump was redeveloped for access to the project. The historic roadway was marred by massive slope failures and deeply incised gullies on fill slopes. The road represented a major eroded surface and source for fine sediment delivery.

At the conclusion of the Monday Camp Dump stabilization task, the road was obliterated. Because riparian vegetation had established along the river, fill slopes were not pulled back and re-graded against the cut banks, but approximately two (2) acres of road surface were scalloped, using a track hoe, and then treated with fertilizer and reseeded. In areas where runoff waters eroded deep gullies, the watercourse was deeply ripped and armored with coarse durable rock. Finally, the entrance to the access road was filled with 36” (and larger) boulders to prevent ATVs from traveling on the reclaimed area.

Monday Camp Dump Stabilization

The East Fork of the South Fork of the Salmon River flowed alongside and undercut over 500 linear feet of the toe of the Monday Camp Dump (Figure 4), contributing approximately 500 tons of what was presumed to be heavy-metals-ladened sediment to the delta beneath the cascade. With no opportunities to relocate the channel, the solution was to *lay back* the entire dump (Figure 5), stabilizing it by soils building and revegetation.

Stream banks were initially excavated to expose materials for testing of hazardous materials and heavy metals and to create a working platform. A long reach track hoe was used to selectively pull back mine wastes and leave established riparian plants.

2 Bentomat is registered trademark of CETCO Lining Technologies.

Figure 4. The river cuts through toe of the Monday Camp dump.

Figure 5. Monday Camp Waste Dump during stabilization task. Note the track hoe near the center of the picture.

Fifty thousand (50,000) tons of mine waste was removed from the dump face and placed on another angle of repose dump face with approximately two acres of vegetated buffer area (Figure 6). The location and the underlying buffer zone ensure that fines eroded and transported down-gradient will be captured and attenuated. Once the mine waste had been removed, the dump was re-graded and scalloped using the track hoe.

Figure 6 Stabilized Monday Camp Dump.

Construction of Sediment Basins and Wetlands on Historic Mine Benches

The Glory Hole consists of numerous historic mining facilities and a public county road that traverses the site. The mine waste dumps, ore stockpiles, mine benches, and roadways were constructed and abandoned with very little regard to drainage and overall stability; modeling suggested that implementation of BMPs in and around the access roads would result in reductions of between one (1) and five (5) tons per year of sediment produced and transported due to mass wasting and erosion.

During DEQ's inventory for organic and top soil resources, three top soil borrow sites were identified that could be developed as sediment traps for post closure BMPs. In addition, DEQ observed that some of the mine's benches were effectively trapping sediment and evolving into ponds and functional wetlands.

After the top soil was removed from the borrow pits, DEQ had its contractor divert the drainage along the county road and the toe of the Northwest Bradley Waste Dump area into three borrow pits and a mine bench that were over-excavated to produce sediment basins. These basins were then roughed up, treated with top soil amendments, and planted with native seed mixtures (Figure 7).

Figure 7. Reclaimed sediment basin alongside of Glory Hole and the public access road was constructed from a top soil borrow source that was developed for the reclamation work in the Meadow Creek Valley.

Reclamation of Bradley Property Timber Project

Figure 8. Bradley Property Timber Project temporary stream crossing prior to reclamation work done under the Glory Hole CWA section 319 Project.

Figure 9. Obliterated Monday Camp Access Road after reclamation of the Monday Camp Dump.

Although a timber project was contracted by the Bradley Mining Company and regulated by the Idaho Department of Lands, the operator failed to fully reclaim the project area. Seizing an opportunity to acquire additional raw materials, DEQ and Thornton Construction salvaged slash and top soil, removed a poorly constructed stream crossing (Figure 8), and completed some of the timber company's reclamation work. When completed, DEQ reclaimed approximately 200' of timber roads and a one-acre area of disturbed lands that had been used to stockpile slash and logs.

Approximately 200 tons of large woody debris and 1,000 cubic yards of top soil were removed from the timber project area (Figure 9). The top soil had apparently been stockpiled during historic mining activities and was not discovered until Thornton construction began reclamation of the timber project. This large woody debris was stockpiled at the Meadow Creek Project site pending its use on constructing vegetated islands and general scatter.

DEQ seeded the reclaimed timber project with approximately 30 pounds of native seed mixes and then used a tri-phosphate chemical fertilizer to help pre-winter germination. Small slash and rocks were placed to impede recreational use and protect the reclaimed areas. It is hoped that this work will result in the elimination of at least one (1) to five (5) tons of fine sediment production and delivery from this area.

Completed Tasks: Meadow Creek

Tasks completed for Meadow Creek include the following.

Revegetation of Meadow Creek Stream Channel

Prior to DEQ's projects, which began in 2003, very little vegetation had begun to establish itself along the stream bank (Figure 10, left). In 2003, volunteers made up of Boy Scouts, high school students and teachers, DEQ and Fish and Game employees, and a local outfitter started planting willow cuttings, and one-year starts of riparian species. Volunteers also helped broadcast native seed mixtures along the channel.

Figure 10. (Left) Meadow Creek Stream prior to 2003 plantings. (Right) September 2005, after plantings.

Figure 11. (Left) Poorly implemented BMPs prior to this project resulted in continued piping of heavy-metals-ladened tailings. (Right) Top soil backfilling and revegetation stabilized the springs, reduced flows, and curtailed delivery of tailings.

Vegetated Islands Development

Initially, it was believed that DEQ's project would not generate enough top soil and amendments to cap the *spent ore disposal area* (SODA). Consequently, DEQ decided to try the longer-term solution of creating productive islands of vegetation from which seed and organic debris would be generated in sufficient quantities to slowly cover and re-colonize the SODA (Figure 12-Figure 14).


Figure 12. Islands were over-excavated one foot below the original surface and then backfilled with a mixture of spent ore, top soil, and compost to an average of one foot above the original surface.


Figure 13. The placement of the backfill mixture created an absorbent island of growing material that would capture and retain surface runoff from the interior of the SODA until the moisture could be evapotranspirated, significantly reducing surface runoff that had previously caused most of the erosion on the SODA benches.

Figure 14. One year after creating the first vegetated islands, lush grassy species and large woody debris hide and shade over 9,000 plantlings of wild roses and lodge pole pines.

In total, for the 2004 and 2005 construction seasons, nine (9) islands, each of which are approximately a quarter-acre in size, were constructed. After one year, the first vegetated islands produced lush vegetation and acted like sponges to hold soil moisture content above ten per cent until mid September.

Development of DEQ Tailings Repositories

During the identification of non-point sources of surface water pollutants, it became obvious that up to 1,000 cubic yards of historic tailings would have to be removed from the stream channel and other locations to stabilize the site. The tailings would also have to be placed in a repository for final disposal.

Because DEQ was planning to construct a lined area to produce compost, it was determined that the repository could be placed beneath, which would provide the base of a composite cap for the repository. In addition, if the facility were located properly, it would not be impacted by surface or groundwater.

Construction began with excavating spent ore from an area approximately 175 feet by 275 feet (Figure 15). The excavation provided for a 150-foot by 150-foot surface that had a 0.5 percent grade towards a 400,000 gallon settling basin. The pond was designed to contain 48 inches of precipitation that may occur in winter, to prevent runoff from the compost into the nearby Meadow Creek.

Figure 15. (Left) Excavated spent ore from storm water ponds and placed as berm. (Right) HDPE liner is placed on compacted tailings above repository.

Approximately 600 cubic yards of excavated spent ore was placed around the whole area as a retention berm. The interior of the composting area and retention pond was then backfilled with tailings to create a subliner approximately one (1) foot thick prior to placement of a 60-mil high-density polyethylene liner and geotextile.

Development of Wetland Communities and Spring Expressions

The SODA’s topography is dominated by two benches that adjoin Meadow Creek. Similar to geologic contact zones, the zone between these benches is a conduit for near surface ground water flow. In several locations, the flow is expressed at the surface as springs, the most notable of which is a five (5) acre area (Figure 16). Until 2004, the areas around these springs were completely devoid of vegetation, and, were sources for the production and delivery of an estimated five (5) tons of metal-bearing fine sediment to Meadow Creek.

Figure 16. Springs are present at the base of the upper SODA bench (left), which became the site for a five acre wetland development to contain and abate fine sediment production and delivery to the adjoining Meadow Creek channel (right).

In 2004, DEQ and its contractor, Thornton Construction, begin to develop these springs into functional wetlands, which would capture storm water runoff and the fine sediment it transported rather than acting as a source. With substantial soil amendments, these areas are already functioning to capture and attenuate sediment from the SODA (Figure 17).

The development of the lower bench wetlands began in 2004, on five acres beneath the most unstable portion of the upper SODA bench. Initially, the access road, which is frequented by recreational traffic, was built up with crushed rock to maintain a firm road base and increase surface water retention time around the springs at the base of the upper SODA bench. Then, approximately 1,000 cubic yards of a mixture of top soil, wood chips, and compost were spread across the entire five-acre area.

Several different surface expressions of the springs were planted to contain stratified vegetative communities (Figure 18). Plantings provided for a slight overlap between each community. In the center of the wetlands, where there is a continuous presence of water, cattails and rushes were planted. From just inside the peripheral edges of the cattails and rushes, to the ephemeral edges of the spring, a mixture of alders, willows, dogwoods, wild roses, and quaking aspen were planted. Lastly, lodgepole pines were planted in uplands areas that tended to dry out before August of each year.

Approximately three (3) more acres on the SODA were determined to be suitable for wetland development (Figure 19).

Figure 17. One year after seeding, approximately fifty per cent of the upland and riparian plantings died from drought and browsing by deer and elk. However, lush grassy species development now hides and shades the remaining plantlings.

Figure 18. One year after planting, thick growths of grasses and forbs hide ten-inch willow, alder, and aspen starts.

Figure 19. Additional wetland sites were developed on slopes where other springs expressed themselves or where annual surface runoff could be retained by placing top soil in a way that created a dam and sediment basin. The dams were planted with upland species while the bottoms of the sediment basins were planted with wetland and riparian species.

In the center of what had been the mine operator's main haul road were springs that easily converted into a nice quarter-acre wetland. Thornton Construction constructed several stair stepped islands and catchment basins immediately above the haul road wetlands, and then cross-ripped the surrounding area. An armored drain was installed to transfer water during spring runoff from the BMPs into natural wetlands at the base of the SODA. Lastly, these BMPs were seeded with native grasses and forbs and planted with approximately 1,000 ten-inch riparian and upland starts.

DEQ estimates that these complimentary BMPs will prevent an annual production and delivery of between one and five tons of metals ladened fine sediment.

As the 2005 construction season ended, DEQ observed that storm water ran off the USDA's repository on the SODA through three distinct watercourses. To contain the fine sediment and curb erosion, Thorn Construction constructed three (3) 1/8 acre islands/sediment basins across the watercourses. These islands/sediment basins were excavated to approximately 18 inches below the original surface of the SODA, and the excavated waste was blended with top soils and compost to develop a high quality growth medium. The islands were then seeded with the native seed mix, scattered with large woody debris and boulders, treated with tri-phosphate chemical fertilizer, and planted with upland and wetland trees and shrubs. Hopefully, these island/sediment basins will develop into functional wetlands.

After observing the success of developing wetlands communities on the SODA, DEQ decided to make use of composite cap on DEQ's repository and the sediment basin at its lower end to develop one last wetland area (Figure 20). Although the two-acre wetland would provide great habitat on top of the SODA, the evapotranspiration that would occur in and around this wetland would eliminate approximately 1.5 acre-feet (500,000 gallons) of recharge through the mill waste to the springs adjoining Meadow Creek.

Figure 20. (Left) Surface runoff and mass wasting of upper SODA bench is one of the more significant sources for fine sediment production ad delivery. (Right) The storm water catchment pond at the composting facility was developed as a wetland to continue to restrict surface water runoff and utilize it to develop a vegetative cover on top of the SODA.

Re-contouring of SODA Bench

The slopes of the upper SODA bench prevented vegetation from becoming established and resulted in high velocities of surface water runoff in the spring—the primary cause of 5-10 tons of metals-laden sediment that was carried to Meadow Creek annually, depending on precipitation.

Development of five acres of wetlands on the lower SODA is anticipated to assimilate any fines being released from the upper bench, or the wetlands may have a limited life. However, the steepness of the slopes of the upper bench was obviously one of the limiting factors to retention of soil moisture and revegetation.

It was determined, therefore, that Thornton Construction should lay the slopes back and treat the slopes with approximately 1,800 pounds of compost per acre, constructing more than 250 micro islands, and planting 120 trees and shrubs in those micro islands (Figure 21). The total area treated in this fashion was approximately 2,000 feet long and 300 feet wide (15 acres).

Development of Armored Drains

DEQ designed and constructed armored drains on the SODA (Figure 22) to convey high flows during spring and storm runoff through a series of sediment basins and wetlands, eliminating annual delivery of approximately five (5) tons of metal-laden sediment from the top of the SODA into Meadow Creek. The drains also decrease the amount of water percolating into the SODA and the subsequent leaching of dissolved metals, and they conserve and direct fresh water into the constructed wetlands and vegetated islands.

Development of Vegetated Micro-Islands

Prior to reseeding the slopes of the upper SODA bench, Thornton Construction dotted the landscapes with micro-islands (Figure 23). Thornton excavated approximately three (3) cubic yards of spent ore and replaced it with topsoil and compost in each of the micro-islands. DEQ then seeded the entire slope and planted four to six ten-inch starts of ponderosa pine and wild roses in each. It is hoped that the lush vegetation that develops on each of these micro-islands will provide long-term seed sources for trees and shrubs and slowly expand outward across the slope.

Figure 21. D-8 Caterpillar with apron feed compost spreader applies approximately 0.25 inches (1,800 lbs/acre) of compost to the surface of the re-contoured upper SODA bench. Subsequently a D-3 Caterpillar dozer cross-ripped the bench parallel to the contours to impede overland flows.

Figure 22. Constructed armored drain connects wetlands constructed at the composting storm water pond to the wetlands constructed on the lower bench of the SODA

Final Closure of Composting Facilities

Figure 23. Micro-islands were constructed on the re-contoured and composted upper SODA bench slope, spaced at approximately 50-foot centers. The micro-islands were constructed by excavating three cubic yards of spent ore, mixing it with two cubic yards of top soil and compost, and then backfilling the excavation. The micro-islands were then seeded and planted with lodgepole pines and wild roses.

Final closure of the 1.5 acre composting facilities played on several design concepts. The composting facilities lay on top of a lined mill tailings repository, which would be left intact, but the repository needed substantial protection against either disturbance or natural erosion and exposure. The remedy was a functional composite cap of top soil, heavy boulders, large woody debris, micro-islands, a constructed wetland, and lush vegetation. The high density polyethylene liner would, in turn, hold winter precipitation near the surface, like a perched aquifer, such that soil moisture would remain high for a prolonged growing season.

Summary

As a direct result of this project, the water quality trend will continue to improve and then stabilize at near pristine values. If the Nez Perce Tribe and USDA Forest Service are successful in obtaining grant monies to eliminate the last fish passage barrier in the Glory Hole, populations of both anadromous and resident fish species should rise sharply in the upper East Fork of the South Fork of the Salmon River and Meadow Creek. Within five to ten years after the project is completed, steelhead, Chinook, bull trout, and westslope cutthroat densities may be expected to reach $10.03/100m^2$, $23.89/m^2$, $8.00/\ m^2$, and $7.01/\ m^2$, equal to some of the population densities found in other tributaries to the below the mine.

South Fork Cottonwood Creek Watershed Enhancement Project – Phase I

Project Goal and Objectives

Goals and objectives for this project focused on the following:

- Cropland critical areas with excessive sheet and rill erosion as well as nutrient and pesticide losses that are impacting or have potential to impact water quality.
- Riparian critical acres with limited shade that produce higher water temperatures and areas with low stream bank stability.
- Animal Feeding Operation (AFO) critical acres that are impacting or have potential to impact water quality with bacteria or sediment during critical runoff periods.
- Road critical areas with excessive borrow ditch erosion and roads where tillage practices extend into the road right-of-way.

Critical area size

There are approximately 9,418 critical acres in the South Fork of Cottonwood watershed.

Treatment objectives

The objective of the South Fork Cottonwood TMDL Watershed Plan – Phase 1 is to recognize the resource concerns within the watershed and restore these resources to the point where the beneficial uses are supported and meet the state standards. With this in mind, the South Fork of Cottonwood Watershed Enhancement Project, in conjunction with the state NPS Program, is implementing a comprehensive program of BMPs to reduce in-stream temperatures, pathogens and sediment entering into the stream system and minimize the effects of nutrient loading on an estimated 4,700 critical acres.

The implementation of the Cottonwood project is a phased approach, with initial projects targeting primarily the South Fork of Cottonwood. The South Fork of Cottonwood has a watershed area of 12,557 acres with about 22 operators. The entire Cottonwood watershed has 124,439 total acres. The objective is to reach 50% of the critical acres within the watershed, or 46,665 critical acres with the ongoing implementation projects.

Acres Treated

We have treated 5,000 acres in the Cottonwood watershed using section 319 and Water Quality Program for Agriculture (WQPA) funds (Table 3). The majority of these acres are in six-year contracts. Other funding sources have treated an additional 517 acres in the South Fork of Cottonwood and 4,880 acres within the entire Cottonwood watershed. The table shows the amount of each BMP installed and the number of acres it treated.

A map showing the locations treated can be found in Figure 25, page 37.

Funding Sources

Acres have been treated using a variety of funding sources, which are grouped into two general categories: section 319/WQPA and other sources. The section 319 and WQPA funds are being used together to extend subgrant agreement times and cost share amounts as needed. The Division II Animal Feeding Operation section 319 grant was used to fund a feeding operation within the Cottonwood watershed.

Estimated pollutant reductions

Estimated pollutant reductions include the following:

- *Sediment* - There has been an estimated decrease in rill and sheet erosion of 10 tons/acre/year due to the implementation of no-till or direct seed; resulting in an erosion decrease of 45,780 tons/year for the Cottonwood watershed (Table 3).
- Approximately 325 head of cattle have been removed from stream banks by installations of fence and water facilities. Vegetative re-growth in these areas can be viewed in the photo documentation section, starting on page 38.
- *Nutrients* - Reduction of sediment losses often results in a reduction of nutrient losses since many nutrients are transported with sediment particles to the water source. Nutrient Management systems use soil tests to identify current soil nutrient levels before fertilizer is applied, reducing excess fertilizer applications.

Table 3. Estimated pollutant reductions for South Fork Cottonwood Creek.

Reduction Estimates					
Practice	Estimated Sediment Reduction	# Implemented	Potential Sediment Load Reduction	Potential Nutrient Load Reduction	Potential Bacteria Load Reduction
Direct seed	10 tons/acre/year	4,578 acres	45,780 tons/year	~500 lbs P/year	none
Sediment Basins & Ponds	15 tons/basin/year	1 basins	15 tons/year	negligible	none
Filter Strips	50% of sediment (average of 15 tons/acre/year sediment.losses)	3 acres	23 tons/year	50% of nutrients will be filtered	50% of bacteria will be filtered
Fencing and offsite water developments	stabilized stream banks in 2 to 5 years	6,533 feet of fence, 5 water developments	~1 ton / year	~500 lbs P2O5 ~300 lbs N	99% of in-stream deposits in treated areas

- Sediment load reductions at the field level are estimated at 45,780 tons/year—25,637 tons/year at the stream level.
- There is an estimated 50% reduction in bacteria and nutrients to live water from filter strips.
- Fencing and offsite water developments work together to eliminate or largely reduce livestock access to live water, creating a 99% to 100% reduction of in-stream manure deposits and, hence, bacteria

Monitoring results or indications

DEQ – A BURP crew monitored during the summer of 2005; results are available through the Lewiston Regional Office.

Nez Perce tribe – Nez Perce Tribe monitoring results for 2005, as summarized by Ken Clark (IASCD), are as follows:

Cottonwood Creek (at Darryl Newman's Bridge -- Mouth)

- Bacteria do not appear to be a problem.
- Phosphorus levels exceeded Idaho criteria of 0.10 mg/L for all but two of the sampling events. Phosphorus levels appear to have an inverse relationship to discharge rates. This is counterintuitive and deserves further explanation; phosphorus binds to soil particles and is typically seen in greater quantities in surface waters when flows and erosivity is highest.
- Total nitrogen levels were said to have violated Idaho criteria during spring flows, but were within acceptable limits during the summer months.
- Total Kjeldahl Nitrogen (TKN) on Cottonwood Creek at Newman's appeared to be very high during the sampling period.

Cottonwood Creek (at Columbus Crossing – prairie/canyon interface)

- Nitrogen and ammonia levels were seen as violating state standards at this site.
- Total phosphorus levels were very high during the sampling period, and showed an inverse relationship to discharge rates. Further investigation should be done; perhaps a type of time-release fertilizer was being used.
- Bacteria were not a problem.
- True discharge rates may have been higher than actually reported for all sites, since negative values were used at different sites to calculate discharge. Since streams do not flow uphill, the negative numbers must be due to measurements taken in an eddy; those numbers should have been discarded.

Cottonwood Creek (at Butte Site -- Headwaters)

This site was only sampled twice; it was frozen one of those times. No violations were observed.

IASCD - The actual results can be found in the monitoring report entitled *Tributaries of Cottonwood Creek Monitoring Results 2002* on the ISDA Web site:

- The monitoring program for Cottonwood Creek Tributaries was successfully carried out as planned. Protocols were followed, QA/QC standards were met, and specific information per TMDL parameter for each sub-watershed was collected.
- Dissolved oxygen exceedances were only observed on streams that almost or did go dry in mid summer.
- Instantaneous water temperatures standards were met at all sites with only one exception: at Shebang Creek, which went completely dry.
- All sites exceeded the Salmonid spawning temperature standard during June and July. All of these streams had discharges of 1 cfs or less during this time. Significant correlations ($p<0.05$) between TSS and TP suggests that phosphorous released into the water column was mobilized by sediment disturbance.
- Observations and the data suggest that grazing is a contributor to sediment mobilization. The data suggest that grazing is the main contributor to sediment mobilization.

- Bacteria problems were greatest around May and June, and the data suggest that grazing is a contributor because cattle were observed in the streams during this time (conclusions from Myler, August 2002).

IASCD monitoring will be performed in the 2005, to monitor success in load reductions in Cottonwood creek and tributaries.

BMP Effectiveness Results

BMP effectiveness reviews –BMP effectiveness will generally be monitored by the IASCD monitoring plan. More specific reviews took place utilizing soil quality, RUSLE, spot checks, and photo plots.

Soil Quality - A total of 34 sites have been sampled within the boundaries of the Cottonwood Watershed on cropland that has been enrolled in the section 319/WQPA conservation programs. Figure 25 shows the location of the sites.

Several different tests were performed and a variety of data collected at each site. The results are shown in Table 4.

Table 4. Baseline soil quality data results for South Fork Cottonwood Creek.

	Minimum	Average	Maximum
Standardized respiration (lbs CO2-C/ac/day)	25	73	210
Infiltration rate (minutes/inch)	1.2	64	600
Surface bulk density (g/cm3)	0.6	0.9	1.2
Subsoil bulk density (g/cm3)	0.8	1.0	1.2
Water Filled Pore Space (WFPS) (%)	11	37	58
EC (dS/m)	0	0.4	0.9
PH	4.9	5.5	6.4
NO3-N (lbs NO3-N/ac)	4.4	22.2	215.8
Water stable aggregates (%)	1.8	37.3	71.7
Average soil slaking rating	1.1	2.4	4.5
Total earthworms (# /ft3)	0	1.5	8
Soil structure index	0	34	75
Organic matter (%)	3.4	5.3	8.0

A summary of the findings includes the following:

- The range in respiration data is highly variable, from medium to unusually high microbial activity, and the data represent this variability. To decrease the effects of field variability due to stage of growth and disturbance, samples in the future should be taken at similar crop stages or in the inter-row.
- Infiltration rates varied widely, from slow (300 to 1,000 min/in) to very rapid (less than 3 min/in) with the average being moderate (30 to 100 min/in). The data showed a trend of minimum-till fields having a slower infiltration rate than fields having four or more years of continuous no-till/direct seed.
- Bulk densities were lower than expected (less than 1.2 g/cm3). More quality control on the bulk density test procedure would potentially uncover any errors being made in sampling or handling of samples.
- Water Filled Pore Space (WFPS) data varied from too dry to optimum. About 30 percent of the samples taken had WFPS below 30 percent, therefore being too dry to standardize the microbial respiration for moisture. If there were an error in the bulk density values or water content values, this would affect the WFPS calculation and may change the values.
- Electrical conductivity (EC) is a measure of the salt content in the soil. All values within the Cottonwood watershed were non-saline, indicating no salt problems exist.
- The range in pH values was 4.9 to 6.4, indicating some acidic conditions. Nitrate availability is limited below a pH of 5.5, which directly affects crop growth. Historic pH ranges (1961 – 1976) for the soils

sampled were from 5.6 to 7.3 (USDA-SCS; 1982). These historic ranges could be contributed to parent material. Decreases in pH values since that time are likely to be caused by fertilization impacts on the cropland. An active nutrient management program has been implemented with the no-till/direct seed program and should minimize these effects in time.

- Nitrate levels at the time of sampling for this project ranged from low to very high. Levels of nitrates seemed to be a direct function of timing. For future samplings and data analysis the fertilizer dates need to be collected to better analyze the data.
- Aggregate stability ranged from highly unstable to stable (65 to 81 percent) for the soil types sampled. Organic matter contents and textures were constant for the sites sampled, so higher values were due to increased root growth and microbial glomalin. Fields that had been in pasture previously where root growth was abundant had the highest aggregate stability and minimum till fields had the lowest aggregate stability. This shows an improving trend as root growth and microbes increase within the soil.
- Soil slaking ratings varied from the unstable range to low stability and strength. For the soils sampled, the variability was in glomalin contents. The higher ratings were, in general, from fields that had been in no-till/direct seed systems for a longer period, indicating no-till/direct seed systems over time are effectively reducing sediment losses from fields.
- Earthworm counts ranged from 0 to 8 worms in a cubic foot. Sampling that is collected too early under cold conditions or too late under hot, dry conditions yielded no worms even in fields with high residue levels. Under optimum sampling conditions, total worms increased with increased residue or food sources, which were more prevalent in a no-till/direct seed system.
- Structure ratings varied from 0 to 75, with the higher rating in fields that had been in pasture prior to being direct seeded. In general, as time in a no-till/direct seed systems increased, the better the soil structure. The better the soil structure the better the infiltration rate, which in turn reduces soil runoff.
- The organic matter contents measured in this study averaged 5.3 percent. The highest organic matter contents were in the fields that had been in pasture before crop production with a direct seed system. In addition to high organic matter contents, fields that have been in a no-till/direct seed system have high levels of decomposing residues on the surface of the soil that hold moisture and reduce soil temperatures allowing better microbial activity and more decomposition of the residues.

In conclusion, this data is good baseline data, indicating a positive trend in soil quality with increased years of no-till/direct seeding. Further testing at the third year and sixth year into the contracts should substantiate this trend.

Administration

The district board set watershed priorities by determining which BMPs would make the most impact towards meeting water quality goals. Cost lists were developed through numerous meetings with the Idaho Soil and Water Conservation District (ISWCD) board, the Cottonwood Creek WAG and the Cottonwood Creek advisory committee. Modifications to the cost lists were submitted to the ISWCD board and approved by the ISWCD board at a regularly scheduled board meeting. NRCS and SCC personnel developed contracts and conservation plans with the District approving the contracts, plans and modifications. The Conservation district compiled payment applications and the ISWCD board approved payments as well as preparing financial records for annual audits.

Public Outreach

The conservation district has implemented an information and education program targeting potential project participants, landowners, and operators within the watershed and Idaho County:

- The first educational program netted twenty-five agreements for contracts.
- Watershed meetings, tours, and newsletters were used to highlight public awareness of BMPs and their effectiveness, the TMDL process and the progress of the implementation plan. Local media outlets were utilized to disseminate watershed activities and broader issues of water quality to the general public. A tour was held June 2002, and 50 people attended. The tour spotlighted the direct seeding and no-till practices being implemented within the Cottonwood watershed, with featured producers discussing their successes and challenges.
- In February 2003 and February 2004, the District gave an update on the project at the annual cereal growers meetings in Greencreek, Idaho. The District also had an informational booth promoting the Cottonwood TMDL Implementation at the Idaho County Fair (August 2001, 2002, 2003, 2004).
- Indirect public outreach was accomplished at the South Fork Clearwater (SFC) WAG meetings in 2003/2004. The SFC WAG was informed of the voluntary participation in the Cottonwood Creek TMDL Implementation.

Total Project Costs

Total project costs are shown in Table 5.

Table 5. Total project costs for South Fork Cottonwood Creek.

	WQPA ($)	319 ($)	Landowner ($)	Other ($)	Total ($)
BMP Cost-Share	105,351	235,705	294,019		635075
Administration	5,596	25,718			31,314
Outreach	606	5,759			6,365
Tech. Assistance				70,000	70,000
Monitoring				15,000	15,000
Other					
Subtotal	111,553	267,182	294,019	85,000	757,754

Project Conclusions and Recommendations

The project has been successful:

- We have educated many landowners, operators and public citizens about water quality issues
- We have had substantial volunteers for water quality projects with more envisioned in the future
- Planned BMPs are working toward the objectives for this project
- Thus far, we have reached 23% of our project critical acres with section 319 and WQPA projects and 34% with all projects for the South Fork of Cottonwood (23% of the total Cottonwood watershed critical acres objective).

Figure 24. July 9th, 2005, DEQ Field review of the Cottonwood section 319 – Implementation of BMPs. Left to right: Cliff Tacke, Cottonwood WAG Chairman; Ed Stuivenga, ISWCD Supervisor; Leon Slichter, ISWCD Supervisor; Jerry West, DEQ; Pete Lane, ISWCD Supervisor; Scott Wasem, ISWCD Supervisor; John Cardwell, DEQ.

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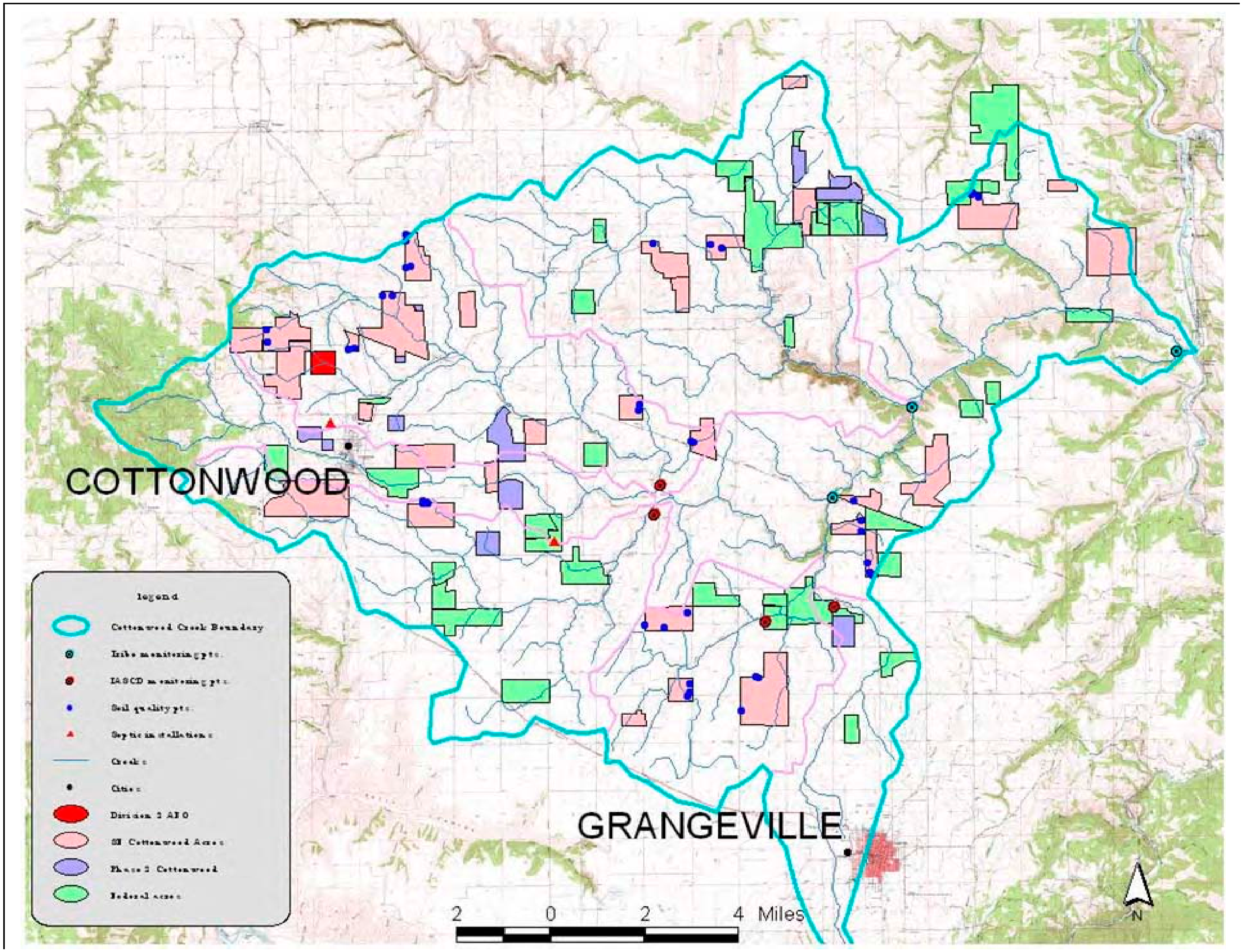

Figure 25. Cottonwood BMP Implementations (11/04).

Implemented Best Management Practices

Figure 26. Direct Seed reduces runoff and sediment losses from fields due to the amount of residue left on the surface. In the Cottonwood area, there is approximately 10 tons/acre/year of sediment reductions due to direct seed and no-till systems.

Figure 27. Residue remaining in this minimum tillage field is significantly lower than residue rates in direct seed systems. The additional residue in direct seed systems slows runoff waters allowing infiltration into the soil and lowers sediment losses from the fields.

Figure 28. Sediment basins collect sediments and reduce the amount of sediment and nutrients entering streams and other water bodies. This sediment basin is seen completed in the fall (right) and full of water and sediments in the spring (left).

Figure 29. The runoff depicted is typical of summer fallow systems in the Cottonwood area before cooperators converted to direct seed systems. In areas where landowners are not converting to direct seed, some landowners are installing sediment basins to collect sediments.

Figure 30. Filter strips, serve to reduce sediment, bacteria, and nutrients entering water bodies. This is accomplished by slowing water velocity, allowing contaminates to settle out of run-off waters.

Figure 31. Fencing (left) reduces impacts to stream banks, and direct access to live water allowing streams to recover and pollutant loads to be reduced. The green re-growth along the creek in this photo is one season of re-growth.

Figure 32. Culvert crossings provide livestock access to additional pasture areas with minimal impacts to stream banks and creek waters.

Figure 33. Sediment Basin two years after installation. Fifteen tons of sediment has been removed each year from this basin.

Figure 34. Corral berms help to contain corral water and manure, allowing pollutants to settle and keeping them from entering the creek.